

Call

On the two occasions the *baudii*-like calls were heard more than one Black-and-crimson Pitta was present, suggesting some conspecific interaction e.g. a territorial border dispute.

Whether male pittas alone or both males and females call apparently has not been documented. If both sexes call, then the two birds approaching in the second observation could have been a pair, and the call could be related to courtship or pair bonding. Also, because of the time of year, the earlier incident on 9 July 2012 could have been related to interaction between a parent and a nearly fully-grown juvenile.

Acknowledgements

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References

- BirdLife International (2013) Species factsheet: *Pitta ussheri*. Downloaded from <http://www.birdlife.org> on 20/02/2013.
- Bostwick, K. (2006) Mechanisms of feather sonation in Aves: unanticipated levels of diversity. *Acta Zoologica Sinica* 52(Supplement): 68–71.
- Chapin, J. P. (1953) The birds of the Belgian Congo. Part 3. *Bull. Amer. Mus. Nat. Hist.* 75A: 25–30.
- Daanje, A. (1950) On locomotory movements in birds and the intention movements derived from them. *Behaviour* 3(1): 48–98
- Erritzoe, J. (2003) Family Pittidae (pittas). Pp.106–162 in J. del Hoyo, A. Elliott & D. A. Christie, eds. *Handbook of the birds of the world*, 8. Barcelona: Lynx Edicions.
- Lambert, F. & Woodcock, M. (1996) *Pittas, broadbills and asities*. Mountfield UK: Pica Press.

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White-shouldered Ibis *Pseudibis davisoni* population size and the impending threat of habitat conversion

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Introduction

Cambodia boasts a rich diversity of large-bodied waterbirds and harbours globally significant populations of several threatened ibises and storks, and a crane (Critical Ecosystem Partnership Fund 2012). While the future of these species remains perilous, recent research has advanced understanding of their ecology and enhanced conservation responses (Keo 2008, van Zalinge *et al.* 2011, Wright 2012, Clements 2013). Greater search effort, collaborative and nationwide monitoring (White-shouldered Ibis Conservation Group 2012, Wright *et al.* 2012b) and species-specific research (Wright 2012) have improved knowledge of the White-shouldered Ibis *Pseudibis davisoni*.

This species was once widespread in South-East Asia but, following a decline in the twentieth century, is now confined to Cambodia and tiny areas of southern Laos and east Kalimantan, Indonesia (BirdLife International 2013). In 2000 the species was classified as Critically Endangered (BirdLife International 2001), with an estimated global population of fewer than 250 mature individuals. Since 2009 birds have been counted at wet-season roosts in Cambodia and in 2010 these revealed a minimum national population of 523 individuals (Wright *et al.* 2012b).

Conversion of habitat to agriculture is one of the greatest threats to the species (White-shouldered Ibis Conservation Group 2012) and to much of Cambodia's globally important forests and grasslands (Critical Ecosystem Partnership Fund 2012). Government land in Cambodia is classified into state public (land for public interest or use) and state private (not for the public and available for private purchase) property. The leasing of both types for economic development through various legal concession mechanisms, particularly as Economic Land Concessions (ELCs), is now the major driver of agricultural expansion in Cambodia (Poffenberger 2009). ELCs are leased to private companies for up to 99 years, and habitats are converted to the industrial-scale cultivation of commodity or energy crops, such as rubber, cassava, sugarcane and jatropha (Sukkasi *et al.* 2010, Open Development Cambodia 2013a). While many concessions have not yet

commenced cropping, publicly available data (Open Development Cambodia 2013b) suggest that more than 2 million ha of ELCs have already been granted. Despite their scale, very few studies have quantified the potential impact of ELCs on threatened species.

This paper reports the latest White-shouldered Ibis censuses in 2011 and 2012, combining roost counts with supplementary data to revise estimates of the Cambodian and global populations. Comparison of the distribution of ELCs and roosting White-shouldered Ibis starkly highlights the imminent threat that the concessions pose to the species.

Methods

The White-shouldered Ibis is a solitary breeder in the dry season (November–April) but gregarious in the wet season (May–October), gathering to roost in tall dipterocarp trees in dry deciduous forest or on river-channel islands (Wright *et al.* 2012a). The species often shows roost fidelity, using many communal roosts repeatedly in both seasons and from year to year. To improve population estimates, White-shouldered Ibis were counted simultaneously at known roosting sites in the 2011 and 2012 wet seasons. Counts were made in five study areas: Kulen Promtep Wildlife Sanctuary, Lomphat Wildlife Sanctuary, Mekong Flooded Forest, Mondulkiri Protected Forest and Western Siem Pang Important Bird Area (Figure 1). Counts have been made here since 2009 (Wright *et al.* 2012b), with the exception of Mondulkiri where counting began in 2012.

Roost sites were located by local people and occasional active searching by field staff. Without doubt some roosts are still to be discovered: few sites were known before 2009, and the study area was large—more than 13,300 km². Total counts therefore provide minimum estimates of population size. The number of roosts surveyed in each study area (Table 1) probably varied due to both the differing capacities of local organisations and the size of the White-shouldered Ibis population in the area. However, knowledge of roost site locations improved with time so that the 32 sites surveyed in 2009 had risen to 68 in 2012. To improve accuracy,

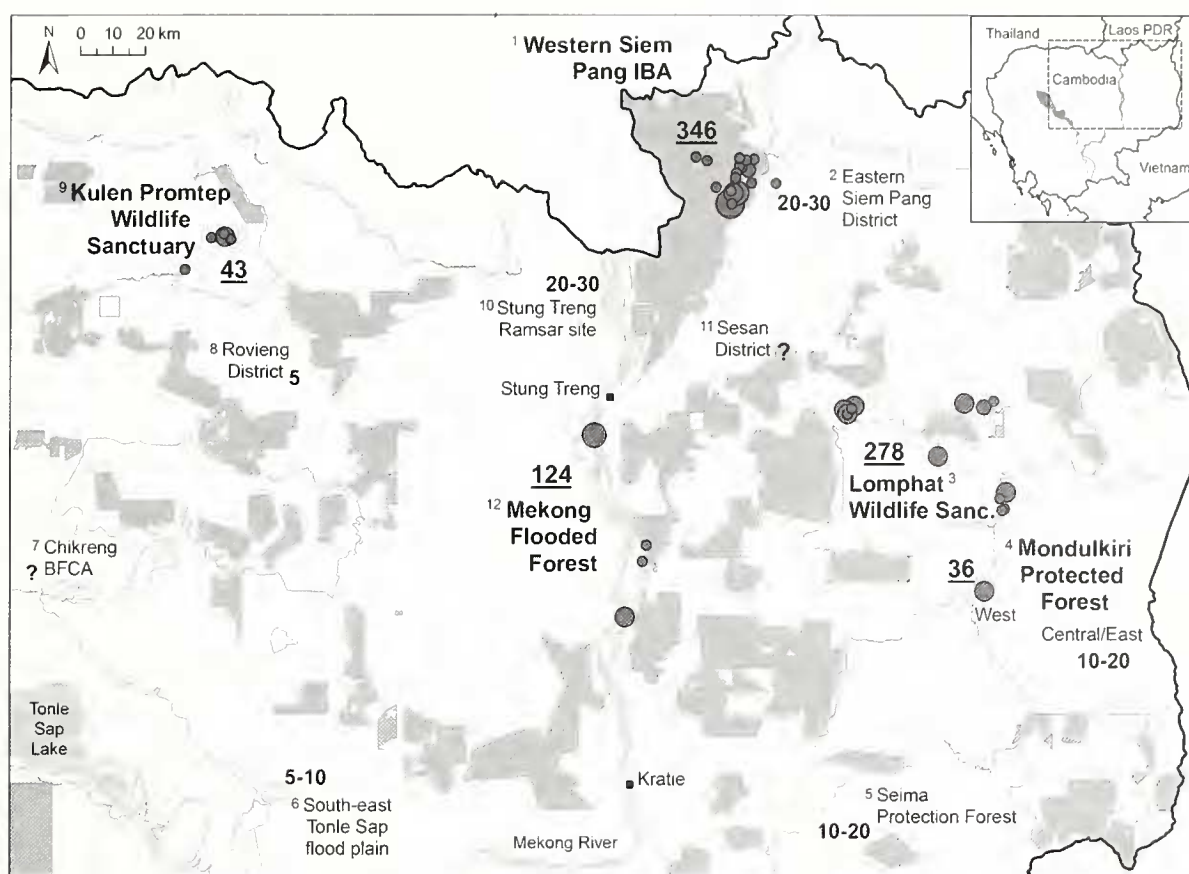


Figure 1. The distribution of Economic Land Concessions (mid-grey areas) in north and east Cambodia and White-shouldered Ibis roost sites (dark grey circles) surveyed in September 2012. Roost circle size (smallest to largest) denotes counts of 1–10, 10–25, 25–50, 50–75 and 75–150 birds. Protected areas are shown by mid-grey outlines. Bold numbers give population sizes; underlined numbers are the highest from roost counts between 2009 and 2012 and other numbers are estimates from supplementary sources. Numbers add up to the estimated Cambodian population. '?' denote locations where single sightings (of <3 birds) have occurred since 2009. The data sources are: ^{1,9} September 2012 roost count; ² HLW unpubl. data; ³ August 2012 roost count; ⁴ west: September 2012 roost count, central/east: T. Gray (*in litt.* 2011); ⁵ Bird *et al.* (2007); ^{6,8} Wildlife Conservation Society unpubl. data; ⁷ Goes (2012); ¹⁰ Timmins (2006); ¹¹ Evans & Goes (2010); ¹² October 2010 roost count (Wright *et al.* 2012b).

roosts were surveyed both in the evening and on the following morning; the larger count at each site was used to calculate the total for the study area on each survey date.

Cambodian and global populations were estimated following Wright *et al.* (2012b): maximum roost counts in each study area from 2009 to 2012 were combined with documented evidence and expert assessment of numbers in other populations, including Laos and Kalimantan, where the species was not accurately counted. Maximum counts in study areas occurred on different dates, so population estimates assume that the five populations are mutually isolated. There is currently no evidence that White-shouldered Ibis travel the tens of kilometres between study areas and Pearson's correlations of all count occasions (excluding Mondulkiri with a low sample size) showed that the number of birds in a given study area was not related to the numbers in any other study area ($P > 0.34$).

To assess the level of threat posed by ELCs to the White-shouldered Ibis population, publicly available GIS datasets (Open Development Cambodia 2013b) were used to determine which roosts were located inside concessions, or within 5 km of concession boundaries, and how many birds were at these roosts during the highest overall count in September 2012. This assessment assumes that birds roosting inside concessions are likely to be severely affected by habitat loss and perhaps face increased disturbance and exploitation. Birds roosting close to concessions will probably be susceptible to loss of foraging habitat, because they may commute more than 5 km from roosts to foraging sites (HLW unpubl. data).

Results

The largest count of White-shouldered Ibis was 754 birds in September 2012 (Table 1). Total counts varied during 2011 and 2012 because (a) poor weather conditions made some roosts inaccessible, (b) some birds used unknown roosts and/or (c) at the time of October counts birds may have already started dispersing for the breeding season. Combining maximum counts in each study area with estimates for minor White-shouldered Ibis populations (Figure 1) suggests that Cambodia holds a population of between 897 and 942 birds. Using this estimate and those of 30 to 100 birds

in Kalimantan and 10 to 20 birds in southern Laos (Wright *et al.* 2012b), 937 to 1,062 birds may remain globally.

Twenty-nine (37%) of the 79 roost sites surveyed in 2011 and 2012 were inside designated ELCs, with 27 of them in Western Siem Pang. Of the 754 birds found in September 2012, 40.8% were at roosts inside ELCs (Figure 1) and a further 15.9% were within 5 km of concession boundaries. Western Siem Pang contributed 99.4% of the birds inside ELCs and 72.3% of those within 5 km of ELCs. A total of 609 birds counted (80.8%) roosted outside protected areas, although 185 (30.4%) of them were at roosts close to the protected area boundary at Lomphat.

Discussion

Counts in September 2012 indicated that Cambodia's minimum known White-shouldered Ibis population was 754 birds, surpassing the previous highest count in October 2010 by 231 birds (Wright *et al.* 2012b). Previous estimates of Cambodian and global population sizes thus need upward revision. While the rise in numbers recorded is probably due to improved knowledge of roost sites rather than a population increase, the record count provides added hope that this species can be safeguarded in the future. Further birds may be found both in known populations (e.g. Mondulkiri, where roost searches have only recently started) and at new sites, such as under-surveyed areas of Stung Treng and Ratanakiri provinces. Nevertheless, additional birds in the five study areas will perhaps be in their tens not hundreds, as the year-to-year increase of maximum numbers at roosts has decelerated (69% more birds were found in 2010 than in 2009, compared with 17% more in 2012 than 2011).

Many White-shouldered Ibis roosted inside or within 5 km of ELCs in the wet (non-breeding) season, suggesting that much of the population is now threatened by habitat loss, increased disturbance and perhaps also exploitation associated with concessions (such as hunting by plantation workers). Most of these birds were found in Western Siem Pang, where concessions now endanger 33–37% of the estimated global population.

The location of roost sites inside or close to ELCs does not necessarily suggest that the species faces extirpation, because roosts occupy only a tiny part of each bird's home range and may

Table 1. Number of White-shouldered Ibis seen during simultaneous counts at roosts in north and east Cambodia, 2011–2012. Underlined numbers indicate when 2011–2012 counts were the highest for the site (or for all sites combined) since roost counts started in 2009 (the highest count for the Mekong was 124 in October 2010). The number of roost sites surveyed is shown in brackets.

Date	Western	Lomphat Wildlife Sanctuary	Mekong Flooded Forest	Kulen	Mondulkiri Protected Forest	Total
	Siem Pang Important Bird Area			Promtep Wildlife Sanctuary		
8–9 Aug 2011	230 (9)	186 (13)	82 (8)	37 (6)		535
8–9 Sep 2011	262 (7)	242 (12)	103 (8)	37 (6)		644
8–9 Oct 2011	208 (7)	223 (12)	121 (8)	39 (6)		591
17–18 Jul 2012	<u>346 (19)</u>	206 (10)	87 (4)	32 (5)	12 (3)	683
20–21 Aug 2012	338 (21)	<u>278 (12)</u>	47 (3)	35 (6)	4 (2)	702
17–18 Sep 2012	321 (22)	251 (11)	103 (4)	<u>43 (6)</u>	<u>36 (1)</u>	<u>754</u>
25–26 Oct 2012	260 (27)	243 (11)	57 (7)	42 (7)	13 (1)	615
Mean no. of roost sites (\pm SD)	16.00 \pm 8.2	11.57 \pm 1.0	6.00 \pm 2.2	6.00 \pm 0.6	1.75 \pm 1.2	

not relate closely to the species's breeding season distribution, when pairs disperse widely. Nonetheless, ELCs are extensive in Western Siem Pang (Figure 1) and sightings and locations of known nest sites (Wright *et al.* 2012a, HLW unpubl. data) suggest that a significant number of birds are also inside the ELCs during the breeding season. Furthermore, the species's dependence on large dry forest landscapes (Wright 2012) and the scale of projected habitat loss across north and east Cambodia in the next 10–20 years suggest that the Western Siem Pang population will not be able to relocate to patches of habitat remaining elsewhere. Birds at other sites may be similarly affected if the spread of ELCs continues unabated.

This study probably underestimates the number of White-shouldered Ibis currently threatened by concessions. Publicly available data do not yet identify all ELCs, and roost counts provide only one measure of threat. In and around Lomphat, for example, many roost sites are outside and beyond 5 km from ELCs, but birds have still been found foraging inside concession areas (SP unpubl. data). Forest clearance has already begun in ELCs in Lomphat (BirdLife International 2012) and continued roost counting will help to monitor the effects of this. Mining concessions, hydropower dams and local-scale agricultural development are also expected to affect key parts of the species's Cambodian range (Bezuijen *et al.* 2008, BirdLife International 2010, Critical Ecosystem Partnership Fund 2012). The White-shouldered Ibis is therefore likely to remain severely threatened for the foreseeable future.

The threats posed to the species are indicative of the conflict between biodiversity needs and national policies for rapid economic development in Cambodia and much of the developing world (Millennium Ecosystem Assessment 2005). Mitigating habitat loss and restricting its effects to areas of lowest conservation value are now major challenges for conservationists (Margules & Pressey 2000, Sodhi *et al.* 2007). Efforts to maintain the integrity of existing protected areas, as well as to safeguard essential sites outside the protected area network (where most birds currently occur), will be vital. Opening dialogue and negotiating with the agro-industry over the use of concession lands is rarely attempted, but could be useful, especially where other approaches fail.

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References

- Bezuijen, M. R., Timmins, R. & Seng T. (2008) *Biological surveys of the Mekong River between Kratie and Stung Treng towns, northeast Cambodia, 2006–2007*. Phnom Penh: WWF Greater Mekong – Cambodia Country Programme, Cambodia Fisheries Administration, Cambodia Forestry Administration.
- Bird, J. P., Mulligan, B. & Gilroy, J. (2007) A report from a BOU supported project: Cambodia ornithological expedition summary of findings. *Ibis* 149: 650–651.
- BirdLife International (2001) *Threatened birds of Asia: the BirdLife International Red Data Book*. Cambridge, UK: BirdLife International.
- BirdLife International (2010) Largest ever White-shouldered Ibis count. *Babbler* 35: 35.
- BirdLife International (2012) Cambodia: the destruction of Lomphat Wildlife Sanctuary. *Babbler* 42: 46–47.
- BirdLife International (2013) Species factsheet: *Pseudibis davisoni*. Downloaded from <http://www.birdlife.org> on 12/02/2013.
- Clements, T. (2013) Influence of institutional arrangements on the outcomes of payments for ecosystem services (PES) programs. Unpublished PhD thesis, University of Cambridge, UK.
- Critical Ecosystem Partnership Fund (CEPF) (2012) *Indo-Burma biodiversity hotspot, Indochina region: ecosystem profile 2011 update*. Arlington: Critical Ecosystem Partnership Fund.
- Evans, T. & Goes, F. (2010) Cambodia recent bird reports, November–December 2010. Available from <http://www.samveasna.org/trip-report.html>. Accessed 12/2/13.
- Goes, F. (2012) Cambodia quarterly bird reports: January–March 2012. Available from <http://www.samveasna.org/trip-report.html>. Accessed 12/2/13.
- Keo, O. (2008) The ecology and conservation of Giant Ibis in northern Cambodia. Unpublished PhD thesis, University of East Anglia, UK.
- Margules, C. R. & Pressey, R. L. (2000) Systematic conservation planning. *Nature* 405: 243–253.
- Millennium Ecosystem Assessment (MEA) (2005) *Ecosystems and human well-being: biodiversity synthesis*. Washington DC: World Resources Institute.
- Open Development Cambodia (ODC) (2013a) Economic land concessions (ELCs). Available from <http://www.opendevdevelopmentcambodia.net>. Accessed 12/2/13.
- Open Development Cambodia (ODC) (2013b) Downloads. Available from <http://www.opendevdevelopmentcambodia.net>. Accessed 12/2/13.
- Poffenberger, M. (2009) Cambodia's forests and climate change: mitigating drivers of deforestation. *Nat. Resour. Forum* 33: 284–296.
- Sodhi, N. S., Brook, B. W. & Bradshaw, C. J. A. (2007) *Tropical conservation biology*. Oxford: Blackwell.
- Sukkasi, S., Chollacoop, N., Ellis, W., Grimley, S. & Jai-In, S. (2010) Challenges and considerations for planning toward sustainable biodiesel development in developing countries: lessons from the Greater Mekong subregion. *Renew. Sust. Energ. Rev.* 14: 3100–3107.
- Timmins, R. (2006) *An assessment of the biodiversity conservation significance of the Mekong Ramsar site, Stung Treng, Cambodia*. Stung Treng, Cambodia: Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme.
- White-shouldered Ibis Conservation Group (WSICG) (2012) Outcomes of the workshop on White-shouldered Ibis conservation in Cambodia: Tuesday 24th January 2012 – Phnom Penh. Phnom Penh: University of East Anglia, BirdLife International, People Resources and Conservation Foundation, Wildlife Conservation Society, WWF.

Wright, H. L. (2012) Synanthropic survival: low-impact agriculture and white-shouldered ibis conservation ecology. Unpublished PhD thesis, University of East Anglia.

Wright, H. L., Collar, N. J., Lake, I. R., Bou V & Dolman, P. M. (2012a) Foraging ecology of sympatric White-shouldered Ibis *Pseudibis davisoni* and Giant Ibis *Thaumatibis gigantea* in northern Cambodia. *Forktail* 28: 93–100.

Wright, H. L., Collar, N. J., Lake, I. R., Net N., Rours V., Sok K., Sum P. & Dolman, P. M. (2012b) First census of White-shouldered Ibis *Pseudibis davisoni* reveals roost-site mismatch with Cambodia's protected areas. *Oryx* 46: 236–239.

van Zalinge, R. N., Tran T., Evans, T., Hong C., Seng K. H. & Barzen, T. (2011) *Census of non-breeding Sarus Cranes in Cambodia and Vietnam, 2011*. Phnom Penh: Wildfowl & Wetlands Trust, Cambodian Lower Mekong Wetlands Project.

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Errata

Choki, T., Tshering, J., Norbu, T., Stenkewitz, U. & Kamler, J. F. (2011) Predation by leopards of Black-necked Cranes *Grus nigricollis* in Bhutan. *Forktail* 27: 117–119.

The paper stated that at least two different leopards had preyed on Black-necked Cranes during the study, based on spot patterns in two different photographs taken by a camera trap (Plates 1 & 2). A re-examination of the photographs has led to the conclusion that the two images are of the same leopard. This does not affect the conclusions and recommendations in the paper. The authors thank Guntram G. Meier for pointing out that the photographs are of the same leopard.

Mahood, S. P. & Eaton, J. A. (2012) The vocalisations of Red-collared Woodpecker *Picus rabieri*. *Forktail* 28: 167–169.

Figures 1–4 accompanying the paper are incorrect. The correct versions are reproduced below. In each case, the first section is the waveform, the second is the sonagram and the third is the spectrum.

Figure 1. The *keck* call of Red-collared Woodpecker (JAE, March 2012, Phong Nha Ke Bang National Park, Vietnam).

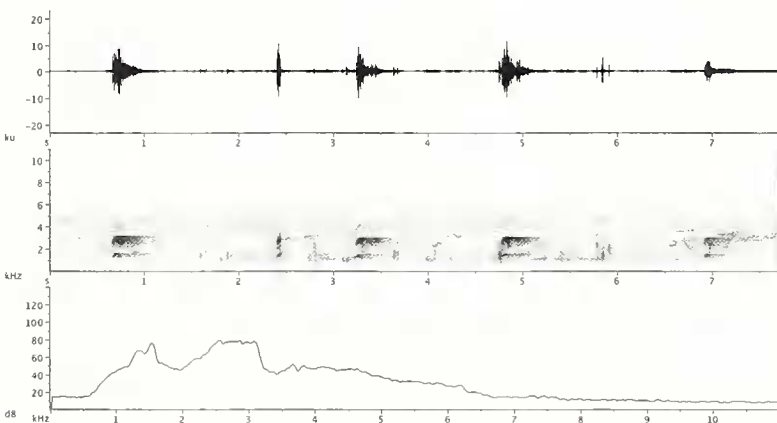


Figure 2. The 'Blue-naped Pitta' vocalisation of Red-collared Woodpecker (JAE, January 2011, Ban Nahin, Lao PDR).

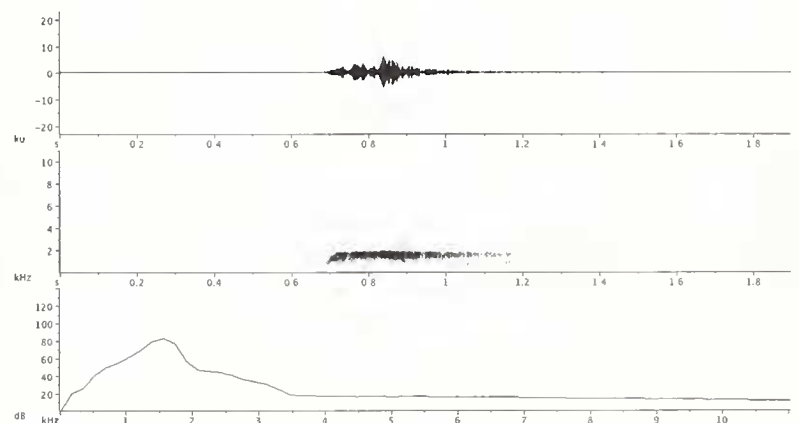


Figure 3. The territorial vocalisation of Blue-naped Pitta (JAE, March 2007, Tam Dao National Park, Vietnam).

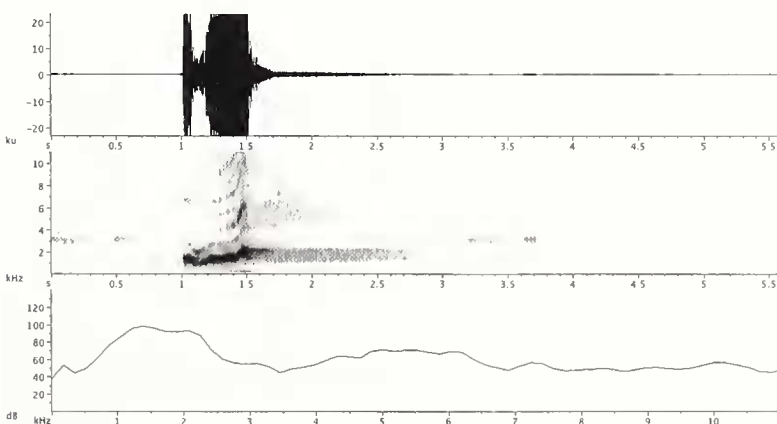


Figure 4. The 'Blue-rumped Pitta' vocalisation of Red-collared Woodpecker (JAE, March 2012, Phong Nha Ke Bang National Park, Vietnam).

